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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/606,894	06/27/2003	Yukio Inazuki	0171-0983P	6145

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EXAMINER

ROSASCO, STEPHEN D

ART UNIT	PAPER NUMBER
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1756

DATE MAILED: 10/03/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/606,894

Applicant(s)

INAZUKI ET AL.

Examiner

Stephen Rosasco

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 23 August 2005.
- 2a) ☐ This action is FINAL. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-15 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-15 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 27 June 2003 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date: _____
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____

Detailed Action

In response to the amendment of 8/23/05 wherein claims 6-15 were added, the examiner withdraws the previous office action rejections including the references, and includes new rejections here based on newly cited references.

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

Claim 1 is rejected under 35 U.S.C. 102(e) as being anticipated by Tomita et al.
(6,436,723).

The claimed invention is directed to a method of manufacturing a phase shift mask blank comprising a transparent substrate and at least one layer of phase shift film thereon, said method comprising the steps of forming the phase shift film on the substrate and surface treating the phase shift film with ozone water having at least 1 ppm of ozone dissolved therein.

And wherein the phase shift film is a metal silicide oxide, metal silicide nitride or metal silicide oxynitride on the substrate and surface treating the phase shift film with ozone water having at least 1 ppm of ozone dissolved therein.

And wherein the metal is molybdenum.

The applicant also states that one important feature for these phase shift masks and phase shift mask blanks is resistance to acids, for example, chemical liquids such as sulfuric acid and aqueous persulfuric acid (mixture of sulfuric acid and aqueous hydrogen peroxide) used in the resist removing and cleaning steps of the mask manufacture process, and chromium etchants having a high oxidizing power used in removal of chromium film.

[0012] Prior art phase shift films are less resistant to chemical liquids and raise a problem that the cleaning or chromium etching step results in deviations of phase difference and transmittance from the preset values.

Tomita et al. teach a method of manufacturing a semiconductor device, comprising the steps of: forming a first metal compound film on a semiconductor substrate, the first metal compound film being formed of metal elements, at least one of which has compound which is difficult to dissolve in water; forming a second metal compound film on the first metal compound film, the second metal compound film being formed of metal elements, each of which makes an easily water-soluble or a volatile compound; forming a protection film having a desired aperture, on the second metal compound film; and etching the second metal compound film exposed from the aperture, by a solution of water containing ozone.

And wherein the second metal compound film is strontium ruthenium compound which is decomposed into an easily water-soluble or a volatile strontium compound through the etching step.

And wherein the solution of water containing ozone is ozone water, which has a concentration of 5 ppm when the ozone water reaches a surface of the second metal oxide film.

wherein in the etching step, the substrate having the second metal compound film made of strontium ruthenium compound is rotated at a speed of 100 rpm or more and the ozone water is directly injected onto the substrate.

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 1-15 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tomita et al. (6,436,723) or Konuma (6,127,279) in view of Tanaka et al. (6,667,135).

The claimed invention is directed to a method of manufacturing a phase shift mask blank comprising a transparent substrate and at least one layer of phase shift film thereon, said method comprising the steps of forming the phase shift film on the substrate and surface treating the phase shift film with ozone water having at least 1 ppm of ozone dissolved therein.

And wherein the phase shift film is a metal silicide oxide, metal silicide nitride or metal silicide oxynitride on the substrate and surface treating the phase shift film with ozone water having at least 1 ppm of ozone dissolved therein.

And wherein the metal is molybdenum.

The applicant also states that one important feature for these phase shift masks and phase shift mask blanks is resistance to acids, for example, chemical liquids such as sulfuric acid and aqueous persulfuric acid (mixture of sulfuric acid and aqueous hydrogen

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peroxide) used in the resist removing and cleaning steps of the mask manufacture process, and chromium etchants having a high oxidizing power used in removal of chromium film.

[0012] Prior art phase shift films are less resistant to chemical liquids and raise a problem that the cleaning or chromium etching step results in deviations of phase difference and transmittance from the preset values.

Tomita et al. teach a method of manufacturing a semiconductor device, comprising the steps of: forming a first metal compound film on a semiconductor substrate, the first metal compound film being formed of metal elements, at least one of which has compound which is difficult to dissolve in water; forming a second metal compound film on the first metal compound film, the second metal compound film being formed of metal elements, each of which makes an easily water-soluble or a volatile compound; forming a protection film having a desired aperture, on the second metal compound film; and etching the second metal compound film exposed from the aperture, by a solution of water containing ozone.

And wherein the second metal compound film is strontium ruthenium compound which is decomposed into an easily water-soluble or a volatile strontium compound through the etching step.

And wherein the solution of water containing ozone is ozone water, which has a concentration of 5 ppm when the ozone water reaches a surface of the second metal oxide film.

And wherein in the etching step, the substrate having the second metal compound film made of strontium ruthenium compound is rotated at a speed of 100 rpm or more and the ozone water is directly injected onto the substrate.

Konuma teach a method of manufacturing semiconductor device comprising the steps of: depositing a semiconductor film comprising amorphous silicon on an insulating surface of a substrate;
forming a patterned mask on a conductive film;
treating said patterned mask with water comprising ozone dissolved in a concentration from 0.1 to 20 ppm; and then etching said conductive film into gate electrodes in accordance with said patterned mask using a liquid etchant.

The teachings of Tomita et al. or Konuma differ from those of the applicant in that the applicant teaches that the method of surface treating with ozone is applied to a phase shift layer of a phase shift mask and is used on phase shift layers of molybdenum silicide.

Tanaka et al. teach a method of manufacturing a photomask comprising the steps of: (a) preparing a mask substrate having a shade portion comprised of a metal in a peripheral region around an integrating circuit pattern region; (b) patterning and forming a first shade portion comprised of a resist film with an integrated circuit pattern in the integrating circuit pattern region to manufacture a photomask on a mask substrate having the shade portion comprised of the metal; wherein said photomask is subject to defect inspection; (c) performing an exposure process on said photomask that passed said defect inspection to transfer a desired pattern onto a substrate to be processed, and (d) stripping the first shade portion comprised of the resist film with an integrated circuit pattern on the photomask to remanufacture photomask blanks comprised of the mask substrate having the metal shade portion.

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And wherein the shade film comprised of the metal comprises a refractory metal, a nitride of a refractory metal, a silicide of a refractory metal, or a laminate film comprising thereof.

Tanaka et al. also teach that DETX (26) the material of the shade pattern 4a is not limited to chromium or chromium oxide, and can be variously changed. For example, a refractory metal such as tungsten (W), molybdenum (Mo), tantalum (Ta), or titanium (Ti), a refractory metal nitride such as tungsten nitride (WN), a refractory metal silicide (compound) such as tungsten silicide (W_{Si}) or molybdenum silicide (MoSi_x), or a laminate film made of these materials may be used.

It would have been obvious to one having ordinary skill in the art to take the teachings of Tomita et al. or Konuma and combine them with the teachings of Tanaka et al. in order to make the claimed invention because the materials used in phase shift mask manufacture and the processing techniques for making the masks from layers are those that are used in making semiconductor devices where surface integrity is also critical, and therefore, an etching solution that is effective for surface treatment for semiconductors would be obvious to use in making phase shifting masks.

Applicant's arguments with respect to claims 1-5 have been considered but are moot in view of the new ground(s) of rejection.

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Conclusion

Any inquiry concerning this communication or earlier communications from the Examiner should be directed to Stephen Rosasco whose telephone number is (571) 272-1389. The Examiner can normally be reached Monday-Friday, from 8:00 AM to 4:30 PM. The Examiner's supervisor, Mark Huff, can be reached on (571) 272-1385. The fax phone number for the organization where this application or proceeding is assigned is (703) 872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

A handwritten signature in black ink, appearing to read 'S. Rosasco', with a stylized, elongated initial 'S'.

S. Rosasco
Primary Examiner
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S. Rosasco
09/26/05